



U.S. Department of Energy Energy Efficiency and Renewable Energy

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INDUSTRIAL TECHNOLOGIES PROGRAM

Highly Energy Efficient D-GLU (Directed Green Liquor Utilization) Pulping

Novel Process Offers Improved Energy Efficiency and Productivity

Maximizing the economics of the pulping operations is one of the highest priorities for the pulp and paper industry in an effort to address increasing wood costs and stagnant mill productivity. However, the high cost of capital retrofits improving the pulping processes can be prohibitive.

Results from a previous project demonstrated in pulp mills in Finland, showed that the novel pulping innovation employing directed green liquor utilization (D-GLU) can provide important energy benefits for mills in the U.S. In addition, pretreatment of pulp before cooking with controlled delivery of mill green liquor (GL) in a mild pretreatment phase (temperature and time), have proven to significantly enhance pulp properties. By rerouting a significant portion (20 to 30 percent) of the GL flow from causticizing to the pulp digester, kraft pulp mills typically handling North American furnishes (i.e.,

Southern pine) could significantly improve energy efficiency and productivity.

The figures below demonstrate how diffusional differences may affect pulping kinetics, especially if a pretreatment is applied before pulping. Each chip was exposed to a uniform environment of hydroxide and hydrosulfide, halved, and then dyed to show the absorption profile of one of the two chemicals. The black color (right) half chips demonstrate sulfide penetration, while the red half chips (left) demonstrate hydroxide penetration. Because of obvious differences between the two chemicals' absorption profiles, kinetic differences in pulping are expected and may be subject to control.

Project Description

This project seeks to develop feasible chemical modifications during kraft pulping operations to obtain significant energy and product



Benefits for Our Industry and Our Nation

D-GLU pulping will provide increased pulp yield, higher fiber strength, lower H-factor at similar control cook kappa numbers, reduced digester alkali demand by as much as 50 percent, offloading of the lime kiln by up to 30 percent, higher pulp bleachability, and reduced energy use by up to 25 percent.

Applications in Our Nation's Industry

The novel D-GLU pulping technology will be a retro-modification to kraft pulp mills producing linerboard and bleachable grade pulp.

Project Partners

North Carolina State University
Raleigh, NC

Institute of Paper Science and Technology
Georgia Institute of Technology
Atlanta, GA

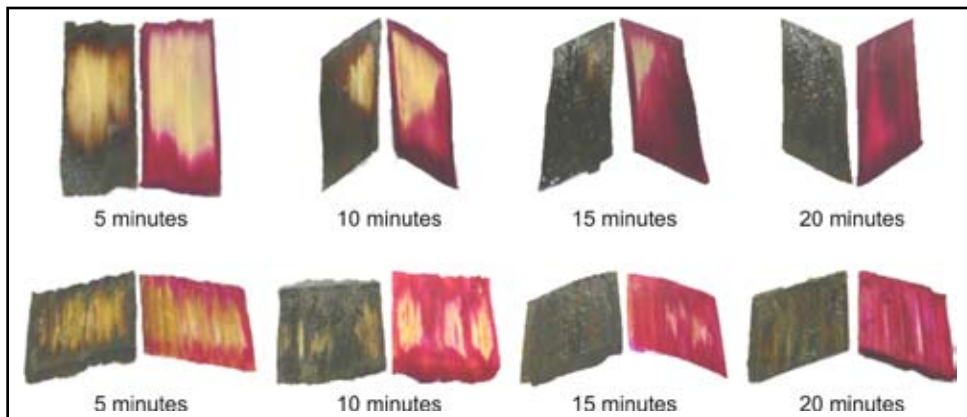
Evergreen Pulp
Samoa, CA

Inland
Orange, TX

Potlatch
Lewiston, ID

Lincoln Paper and Tissue
Lincoln, ME

Wego Chemical & Mineral
Great Neck, NY



Top row: Penetration of sulfide (left) and hydroxide (right) into sweet gum chips at 103°C.

Bottom row: Penetration of sulfide (left) and hydroxide (right) into Southern softwood chips at 103°C.

benefits for U.S. kraft pulp and paper mills. This project will also focus on providing a cost-effective retro-modification to kraft pulp mills (i.e., linerboard and bleachable grades), in addition to developing an engineering design and implementation plan for the additive-enhanced GL process. The expected outcome is to introduce a valuable and economical pulping innovation optimized to provide significant energy savings and increased productivity in the U.S. industry.

Barriers

- Engineering of capital, liquor flows, and recovery for maximum benefits
- Environmental and scaling issues regarding nitrogen emissions during recovery due to inclusion of the organic additive, higher sulfide off gassing in cooking, and scale in the digester and/or evaporators
- Understanding the function of the nitrogen-based organic additives

Pathways

The objectives of this project will be achieved through (1) determining how to handle the GL flows; (2) performing applied and fundamental studies for the pulping catalyst; (3) selecting

a mill and exploring any mill-specific issues related to odor, environmental concerns, solid impacts, and corrosion; and (4) performing mill trials. Mill trial preparations at the Evergreen Pulp mill site in Samoa, CA are currently underway and will run until mid-2006. Following successful implementation of this trial, subsequent mill trial preparations with remaining sponsors are anticipated.

Milestones

- Research how the build-up of scale in the pulp mill and downstream occurs
- Answer questions regarding GL recausticization
- Research and analyze economic use and application of additive-enhance GL pulping
- Develop final research report to consortium on implementation plan

Commercialization

The industrial sponsors will provide mill pulping facilities, personnel, and other resources (i.e., chips, liquors) to implement work and coordinate mill trials. Success in this program will generate interested stakeholders and ultimately increase market penetration.

For additional information, please contact:

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A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

For more information contact:
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